



EFFECT OF A MIXTURE OF HOMOFERMENTATIVE LACTIC ACID BACTERIA ON THE FERMENTATION QUALITY OF LIQUID FEED CONTAINING PEA AND LUPIN MEAL

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BACKGROUND & OBJECTIVE

- Lactic acid bacteria (LAB) are used as inoculum to reduce substrate pH rapidly
- Pulses (e.g. beans, peas, lupins) are frequently included in pig diets in Europe. A strategy to reduce the carbon footprint of production and reduce the reliance on imported protein sources
- Liquid feeds, containing ground pulses are more difficult to acidify, due to their high protein content and buffering capacity
- Liquid feed with high crude protein content could potentially benefit from inoculation and controlled fermentation

Objective

Investigate the fermentation kinetics of pea and lupin meal in response to inoculation with a mixture of homofermentative lactic acid bacteria

MATERIAL & METHODS

- A batch fermentation experiment with basic pig liquid feed rations using PVC vessels (1 L) was carried out
- Fermented liquid feed rations, containing peas mixture or lupins mixture were compared
- Inoculation treatments: (1) control (**CON**: no additive); (2) inoculated with a mixture of three homofermentative LAB (**adLAB**: *Lactobacillus paracasei*, *Pediococcus pentosaceus* and *Lactobacillus rhamnosus*); dosage: 2.0×10^5 CFU/g liquid feed
- The liquid feed rations were fermented at 37° C for 24 h, samples were fermented in replicates (n = 4)
- Measured parameters: pH (0 and 24 h), concentration of lactic acid, acetic acid, propionic acid, butyric acid, 1,2-propandiol, propanol, and ethanol (after 24 h)
- Data were analyzed using PROC MIXED (SAS Version 9.4). The model included the fixed effects of substrate, treatment, and their interaction. The fermentation vessels were considered a random effect.

RESULTS

- Addition of LAB resulted in lower pH (24h) compared to CON in both liquid feed mixtures (peas and lupins, see table)
- Lactic acid concentrations in both adLAB treatments were significantly higher compared to both CON
- Adding LAB resulted in significantly lower concentrations of acetic acid, butyric acid, and ethanol in the lupin and pea mix compared to CON

Table Crude protein, liquid feed pH and fermentation end products (all g/kg DM) of fermented mixed liquid feed rations containing peas and lupins without (CON) and with homofermentative lactic acid bacteria (adLAB) for 24 h (n = 4)

Item ¹	Pea mix		Lupin mix		SEM	Sub ⁵	P-values ⁴	
	CON ²	adLAB ³	CON ²	adLAB ³			Inoc ⁶	Sub x Trt ⁷
Crude protein (0h)	208	208	313	313				
pH (0h)	6.03 ^a	6.03 ^a	5.85 ^b	5.88 ^b	0.028	<0.001	0.547	0.666
pH (24h)	4.57 ^b	3.87 ^c	4.76 ^a	3.90 ^c	0.017	<0.001	<0.001	0.000
Lactic acid	9.91 ^c	44.36 ^b	10.76 ^c	55.82 ^a	1.091	0.000	<0.001	0.000
Acetic acid	10.84 ^a	0.88 ^b	11.34 ^a	1.55 ^b	0.546	0.304	<0.001	0.878
Butyric acid	13.90 ^a	0.04 ^b	15.28 ^a	0.70 ^b	0.883	0.270	<0.001	0.690
Ethanol	6.76 ^a	1.24 ^c	2.52 ^b	0.88 ^c	0.141	<0.001	<0.001	<0.001

¹Concentrations of 1,2-propandiol and n-propanol were below detection limit (<0.001 g/kg DM) in all fermentation vessels

²Control

³Both adLAB liquid feed rations were supplemented with a mixture of *Lactobacillus paracasei*, *Pediococcus pentosaceus*, and *Lactobacillus rhamnosus* at 2.0×10^5 CFU/g fresh liquid feed

⁴Within a row, means without a common superscript letter differ (P < 0.05)

⁵Substrate (Sub)⁵ = pea mixture and lupin mixture; ⁶Treatment (Trt) = CON or adLAB

⁷Interaction substrate x treatment

CONCLUSION

Inoculation with selected homofermentative LAB (*L. paracasei*, *P. pentosaceus*, and *L. rhamnosus*) is beneficial, particularly when liquid feeds with high CP content and buffering capacity, are fermented. Fermented liquid feed pH <4.5, which is the common threshold to suppress undesired microorganisms such as enteropathogenic *E. coli*, *Salmonella*, and *Klebsiella* (Scholten et al., 1999), was only achieved by LAB supplementation.

Reference:

Scholten, R.H.J., van der Peet-Schwering, C.M.C., Verstegen, M. W. A., den Hartog, L. A., Schrama, J.W., Vesseur, P. C., 1999. Fermented co-products and fermented compound diets for pigs: a review. *Anim. Feed Sci. Technol.* 82: 1 -19.